32. A composition used for forming a pattern formation of a hole injecting and transporting layer of an organic EL element using an ink-jet recording head, the composition comprising at least a material for a hole injecting and transporting layer and a polar solvent as a solvent.

33. An organic EL element comprising a hole injecting and transporting layer formed by pattern formation using an ink-jet recording head, the hole injecting and transporting layer containing the composition of claim 31 or 32.

34. The organic EL element of claim 33, wherein a thickness of the hole injecting and transporting layer is 0.1μm or less.

35. The organic EL element of claim 33, wherein a film resistance of the hole injecting and transporting layer is in the range $0.5 \times 10^9\ \Omega/m^2$ to $5 \times 10^9\ \Omega/m^2$.--

REMARKS:

Minor changes are made to this specification. Claims 1-8, 16 and 17 are canceled without prejudice. Claims 9-15 and 18-20 are amended. New claims 21-35 are added. Claims 9-15 and 18-35 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

The specification was objected to because of informalities. All defects pointed out by the Examiner have been corrected. No new matter is introduced.

Independent claim 17 is canceled and replaced by independent claim 21. Independent composition claims 1-7 are canceled and their respective subject matter incorporated into new dependent process claims 22-28, which depend from claim 21. The limitation in claims 21-28 that the conductive material contain "at least polyethylenedioxithiophene and polystyrene sulfonic acid" is supported by the specification at, e.g., pages 25-26. In addition, the phrase "conductive material" is used in lieu of "conductive compound", as the conductive material may be a mixture of two or more compounds. Claim 8 is canceled. Claims 9-15 and 18-20 are amended to depend from the new process claims 21-28. Claim 16 is canceled and replaced by claim 29, which is directed to a process of manufacturing a composition used for a hole injecting

and transporting layer. The method steps recited in claim 29 are supported by the specification at, e.g., pages 20-21. New claims 31 and 32 are directed to a composition, and new claims 33-35 are directed to an organic EL element containing the composition of claims 31 or 32.

Claims 1-20 were rejected as being indefinite. These objections either become moot or have been corrected. Specifically, regarding claims 1-7 and 17, the term "type" and the limitation "... 0.01 wt% to 10 wt%" were deemed vague and indefinite. Claims 1-7 and 17 have been canceled, and the replacement claims 21-28 are believed to be free of any indefiniteness.

Regarding claims 1, 4, 6 and 7, the Examiner stated that the contact angle is not a feature of the composition. These claims have been canceled, and the replacement claims 22-28 are directed to a method rather than a composition.

Regarding claim 8, the rejection is moot due to the cancellation of this claim.

Regarding claim 9, the phrase "as a polar solvent" has been changed as suggested by the Examiner.

Regarding claims 12 and 13 (identified as claims 11 and 12 in the Office Action), the term "a Cellosolve solvent" has been changed to "at least one solvent selected from the group consisting of mono and dialkyl ethers of ethylene glycol and their derivatives". This does not introduce new matter as the term "Cellosolve" (TM Union Carbide) is commonly known as a name referring to the above family of compounds (see Hawley's Condensed Chemical Dictionary, 12th Ed., 1993, page 235, attached).

Claims 1-16 were rejected as being anticipated by Itoh (U. S. Pat. No. 5,690,721). Claims 1-10 and 12-16 were rejected as being anticipated by Taniguchi et al. (U. S. Pat. No. 5,667,572). Claims 1-9 were rejected as being anticipated by Adamic et al. (U. S. Pat. No. 5,188,664). Claim 18 was rejected as being anticipated by or obvious over Shieh et al. (U. S. Pat. No. 5,641,611). Claims 1-7, 17 and 18 were rejected as being obvious over Roitman (U. S. Pat. No. 5,972,419) in view of Yatake (U. S. Pat. No. 5,560,770). Claims 19 and 20 were rejected as being obvious over the '611 patent in view of VanSlyke et al. (U. S. Pat. No. 5,059,862), Shi et al. (U. S. Pat. No. 5,554,450), Shi et al. (U. S. Pat. No. 5,817,431) or Tang (U. S. Pat. No. 4,356,429). These rejections are moot due to the cancellation of all independent claims and the amendment of the dependent claims that remain. The newly added claims 21-35 are believed to be patentable over the cited references for reasons that follow.

The present invention relates to compositions for a hole injecting and transporting layer having suitable physical properties (such as viscosity and surface tension) that make them advantageous for use with an ink-jet recording head to form EL devices. It also relates to a method of forming EL devices with an ink-jet recording head using such compositions.

Independent claim 21 is directed to a manufacturing process for an organic EL element having a stacked structure, the process including a step of filling the openings of the partitioning member with a composition for the hole injecting and transporting layer, the composition comprising a conductive material and a solvent. Claim 21 requires that the conductive material contain at least polyethylenedioxithiophene and polystyrene sulfonic acid. This limitation is neither described nor suggested by any of the cited references. Independent claim 29 is directed to a composition used for a hole injecting and transporting layer of an organic EL element, the composition comprising a conductive material containing at least polyethylenedioxithiophene and polystyrene sulfonic acid and a solvent. Independent claim 31 is directed to a composition used for forming a hole injecting and transporting layer of an organic EL element using an ink-jet recording head, the composition comprising at least polyethylenedioxithiophene and polystyrene sulfonic acid.

Independent claim 30 is similar to claim 21 except that the composition for the hole injecting and transporting layer comprises "at least a material for a hole injecting and transporting layer and a polar solvent". Independent claim 32 is directed to a composition used for forming a hole injecting and transporting layer of an organic EL element using an ink-jet recording head, the composition comprising at least a material for a hole injecting and transporting layer and a polar solvent as a solvent. These limitations of the newly added claims are not described or suggested in any of the cited references, as discussed in detail below.

Itoh '721 relates to a water-base ink for ink jet recording. The ink composition comprises a water-insoluble colorant, a water-soluble organic solvent, and water. Taniguchi '572 relates to an ink composition which can provide a print having better water fastness and is less likely to clog the recording head. The composition contains a colorant insoluble or sparingly soluble in water, a water soluble solvent capable of dissolving the colorant, a saccharide and/or polyvinyl pyrrodidone, and water. Adamic '664 relates to an anti-coalescent ink composition having an additive for reducing the surface tension of the composition and increasing the drip mass per firing. The additive contains at least one polyether polyol. Yatake '770 relates to an ink

composition that can realize printing with less bleeding. The composition contains a dye, PGmBE and/or DPGmBE and another water soluble glycol ether. These four references are completely unrelated to an EL element, process steps for forming the EL element, or an composition used for a hole injecting and transporting layer of an EL element. As such, they do not teach or suggest the claimed composition for a hole injecting and transporting layer, much less the specific compositions recited in the claims, i.e., "a conductive material ... containing at least polyethylenedioxithiophene and polystyrene sulfonic acid" (claims 21-29 and 31), or "at least a material for a hole injecting and transporting layer and a polar solvent" (claims 30 and 32).

Shieh '611 describes a process of fabricating an organic LED matrix. The method involves forming a cavity 20 in a layer 14 covered by a rigid layer 15 having an opening 19 smaller than the cavity 20, and depositing items 30, 32, 34 at the bottom of the cavity by aiming sources (vacuum evaporation chambers) 31, 33 and 35 at the opening 19 from different angles. The items 30, 32 and 34 are materials to form an organic LED element (col. 5, lines 10-26), but their compositions are not described. Thus, Shieh fails to describe or suggest the compositions of the hole injecting and transporting layer required by the present claims. Further, the sources 31, 33 and 35 in Shieh are vacuum evaporation chambers, which are completely different from ink-jet recording head used in the present invention. Unlike for an ink-jet recording head, the source material suitable for such evaporation chambers most likely will not contain a solvent as required by the present claims.

Roitman '419 describes a method of forming an EL display, including the use of a dispenser 136 (such as an inkjet printer mechanism) for dispensing droplets 138 of EL material into wells 133 formed on the substrate by a photoresist mask 131 (Fig. 2). The material is dried and the mask is removed to form the EL pixels. Roitman describes using electroluminescent dyes such as polyflourenes dissolved in a carrier liquid such as xylene. Nor further examples are given. These materials are nothing but the conventional materials used in such systems. Since Roitman is not particularly concerned with the physical properties of the EL material and their advantages or disadvantages for use with a ink-jet recording head, he provides no suggestion or motivation for using the particular composition as recited in the present claims, i.e., "a conductive material ... containing at least polyethylenedioxithiophene and polystyrene sulfonic

acid" (claims 21-29 and 31), or "at least a material for a hole injecting and transporting layer and a polar solvent" (claims 30 and 32).

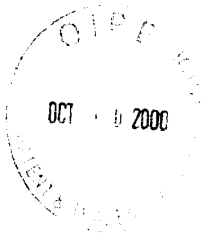
VanSlyke '862 is directed to an EL device with improved cathode. VanSlyke uses porphyrinic compounds to form a hole injecting layer and aromatic tertiary amines to form a hole transporting layer. The materials selected by VanSlyke were preferred because they are capable of vacuum vapor deposition (col. 13, lines 41). Shi '450 is directed to organic EL devices with high thermal stability. For the hole transport layer, Shi uses a polyaromatic amine which has a glass transition temperature above 100°C. Shi '431 relates to an electron injecting material for an organic EL device. Tang '429 describes an organic EL device using a porphyrinic compound for a hole injecting layer.

None of these reference describes a method using an ink-jet recording head for forming the hole injecting and transporting layer; nor do they describe a composition for the hole injecting and transporting layer as presently claimed, namely, "a conductive material ... containing at least polyethylenedioxithiophene and polystyrene sulfonic acid" (independent claims 21, 29 and 31), or "at least a material for a hole injecting and transporting layer and a polar solvent" (independent claims 30 and 32). Accordingly, the cited references, either taken alone or in combination, do not teach or suggest the above independent claims. These claims, as well as claims 9-15, 18-20, 22-28 and 33-35 that depend therefrom, are therefore believed to be patentable.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6700 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.



Respectfully submitted,

HOGAN & HARTSON L.L.P.

Date: October 5, 2000

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